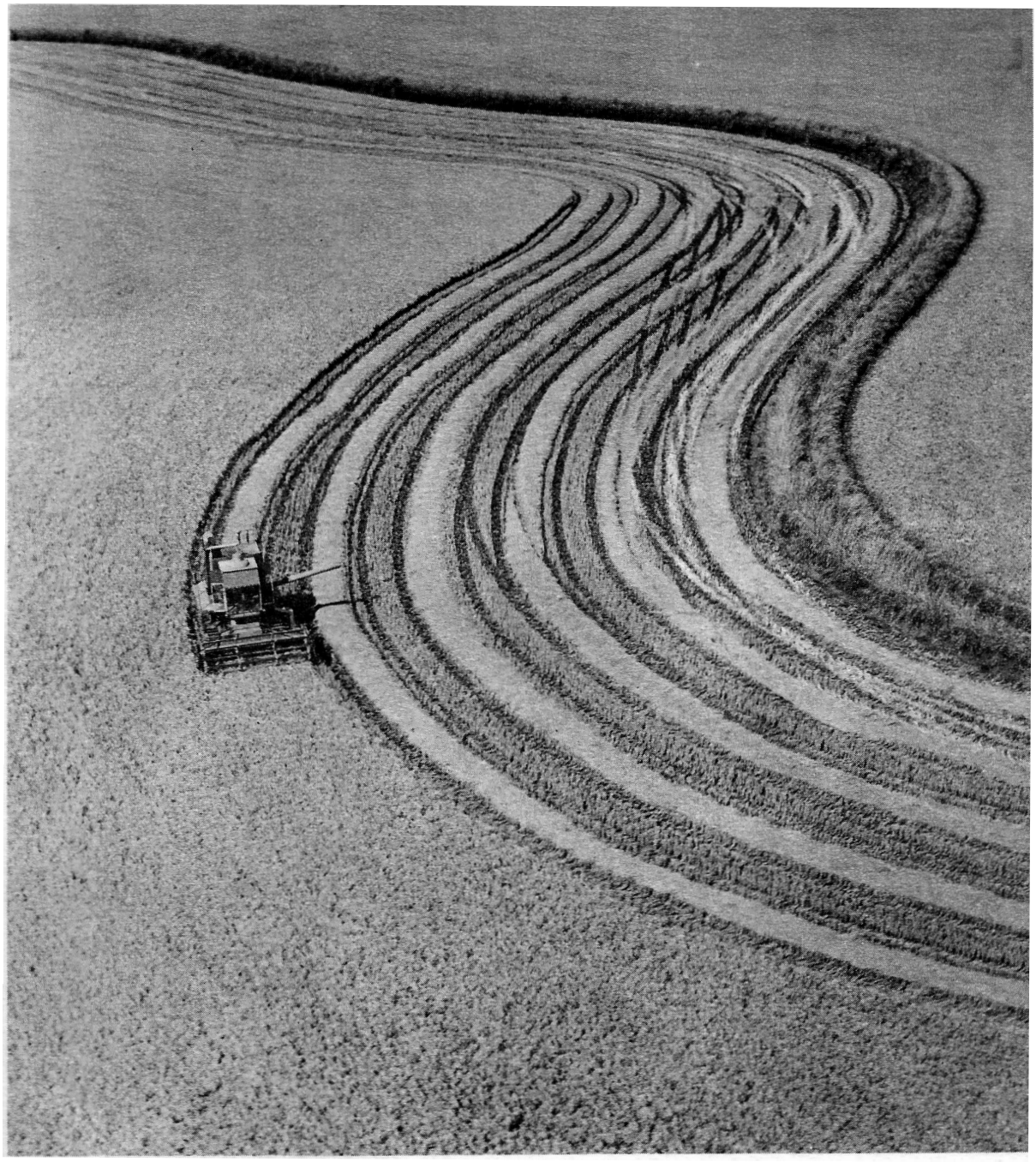
RECONNAISSANCE SOIL SURVEY OF SUTTER COUNTY



APRIL 1965

UNIVERSITY OF CALIFORNIA AGRICULTURAL EXTENSION SERVICE

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APRIL 1965--1½M

RECONNAISSANCE SOIL SURVEY

A soil reconnaissance survey of Sutter County was made by the University of California Agricultural Extension Service to provide basic information about the soils and their distribution. This survey increases the detail in the Soil Survey of the Marysville Area, California, 1909, and the Reconnaissance Soil Survey of the Sacramento Valley, California, 1915. In addition, information from recently completed, unpublished surveys by the Soil Conservation Service and other agencies was used in compiling the map and report.

Soil surveys provide information useful in predicting adaptability of soils to various crops, and the behavior and productivity of these soils under different management systems. The maps are useful in farm planning where the cropping system, tillage methods, erosion control, irrigation, drainage, and fertilization are indicated by the soil type. The soil map can provide prospective farm purchasers with more relevant information upon which to make a decision than does any other publication.

Factual soil data are aids to land-use planning for agricultural use and for the orderly selection of sites for roads, schools, and other social service facilities in rural areas. Soil surveys are being used increasingly for engineering work, especially in highway and airport planning, and in constructing and predicting trafficability for heavy vehicles.

Soil surveys are made at different degrees of detail. This survey differs from a detailed soil survey in the small scale of the map and in the fewer numbers of soil observations made. A description of the methods used is included in the soil section of this report.

The entire area of Sutter County is included in this survey.

Copies of the Soil Reconnaissance Map of Sutter County are obtainable from the Agricultural Extension Service –
P. O. Box 628, Yuba City, California.

DESCRIPTION OF THE AREA

Sutter County is situated on the east side of the central portion of the Sacramento Valley. The major portion of the county lies between the Sacramento River on the west and the Feather River on the east. Approximately one-fifth of the county lies south of the Bear River and east of the Feather and Sacramento Rivers to a point reaching approximately 10 miles north of the city of Sacramento. Sutter County is bounded by Placer and Yuba Counties on the east, Butte on the north, Colusa and Yolo on the west, and Sacramento County on the south. The county has an area of 385,000 acres. Its rapidly increasing population of 33,380 in 1960 represents a growth of 28 per cent more than the population of 26,140 in 1950.

HISTORICAL DEVELOPMENT

Development of the eastern portion of the Sacramento Valley centered in the Yuba-Sutter area since the first settlements in the 1800's. The agricultural development in Sutter County began with the growing of grain about 1845 near the site of Captain John A. Sutter's Hock Farm south of Yuba City. Early agriculture on the floor of the valley was stimulated by an influx of settlers during and after the Gold Rush, but for many years it was restricted largely to dry-farm grain crops and stock raising.

The early settlement of the valley and the development of agriculture were confined to distances within easy reach of the large rivers, since the sole method of shipping produce and receiving supplies was by steamers plying these streams. The outlying areas were devoted to cattle until the construction of the transcontinental railroad (1866) gave this area an easy method of transportation and the entire region was given over to wheat. Some diversions of water from the rivers were made in the late 1800's for irrigation, but the more rapid increase in the irrigated acreage occurred after 1910. At this time, diminishing profits from grain farming and the development of more satisfactory pumping plants increased the interest in subdivision and colonization of the old grain farms. The transition from dry-farming to irrigated cropping continues.

The area is primarily agricultural, although there is some industrial development in the Yuba City area which supports the agricultural industry. These industries include packinghouses, canneries, freezers and dehydrators for fruits and vegetables, and warehouses and driers for rice and other field crops. Several lumber reprocessing and molding plants in the area produce finished lumber and byproducts. Sand and gravel works supply local demand for aggregates, while concrete pipe generally used for irrigation distribution systems is manufactured locally. An extensive natural gas field has been developed in the western portion of the county.

NATURAL FEATURES

Sutter County is located near the center of the Sacramento Valley. The land features of the Valley are closely associated with the uplift and subsequent erosion of the Sierra Nevada. The valley was formed by a tilting of a segment of the earth's crust. At times, it was a landlocked sea where the debris from the mountains was sorted by sea water. The area is composed primarily of basins—the American and Sutter Basins and Butte Sink. The southeast portion of Sutter County is a gently rolling plain which merges into the nearly flat American Basin. Gently sloping alluvial fans lie along the rivers, providing natural levees for the protection of the low-lying Sutter Basin and Butte Sink. The Sutter Buttes, a volcanic remnant located in the northwest corner of the area, rise to 2,132 feet.

DRAINAGE

The general drainage of the area is to the south, with slopes of as little as 1 foot to the mile. The Sacramento River provides drainage for the Sacramento Valley and the mountains to the northeast and west. The Sacramento River is joined near Verona by the Feather River, and near Nicolaus by the Bear River. These streams, along with minor streams, provide the main drainage from the Sierras, lying immediately east of Sutter County.

The control of winter and spring flood waters from the various rivers and streams and a movement of surplus waters through the sloughs of the flat basin lands have long been problems in this region. Surface waters from the north enter the county in the Sacramento and Feather Rivers and the overflow lands of Butte Sink and Butte Creek.

The Sacramento River Flood Control Project is a comprehensive system of leveed river and bypass channels, with the appurtenant weirs and control structures along the Sacramento River. Excess water from the Sacramento River flows into Butte Basin over the riverbank at Chico Landing and at Moulton and Colusa Weirs. These flood waters are then passed through the Sutter bypass with additional water diverted from the Sacramento River over the Tisdale Weir. The flood waters rejoin the Sacramento River south of Knights Landing where, if necessary, they are diverted into the Yolo bypass at the Fremont Weir.

Flood protection from the east on the Feather, Yuba, and Bear Rivers is provided by a system of levees maintained by reclamation and levee districts.

Drainage within the county is provided principally by drainage ditches and pumping plants to elevate the water over the levees. The natural waterways in the area include Coon and Pleasant Grove Creeks, Markham and Auburn Ravines draining into the Sacramento River near Verona by way of the Cross Canal.

Gilisizer Slough flows more or less parallel to the Feather River through the west side area into the Sutter bypass. Wadsworth Canal and its tributaries, with other minor channels, drain a portion of the county north and east of the Sutter Buttes.

GEOLOGY

The geological formations in Sutter County include pre-Cretaceous, metamorphic and igneous rocks of the Sierra Nevada block which extend beneath the valley fill, overlayed principally by Tertiary sedimentary formations derived from these and other rocks which are exposed in the Sierra Nevada to the east. Sedimentary rocks of both marine and continental origin frequently are imbedded within tuff-breccias. The bulk of the area is comprised of the Victor formation of the Pleistocene age. Overlying the Victor formation is recent alluvial.

Volcanic rocks also are represented in the area by the Sutter Buttes which are the erosional remnants of an extinct Pliocene volcano.

Only sedimentary rocks can be considered as water bearing to any appreciable degree. The principal aquifers are composed of continental sediments of the Pleistocene and Recent ages. These consist of as much as 100 feet of Pleistocene sands and gravels overlayed by 125 feet of recent alluvial fan, flood plain, and stream channel deposits.

CLIMATE

The general climate of Sutter County, as other sections of the Sacramento Valley, has two contrasting seasons: a wet, rather cold winter followed by a hot dry summer. The two seasons are of somewhat indefinite duration, but roughly are divided into a 7-month wet season, from the middle of October through May, and a dry season with high temperatures during July, August, and September. The rainfall averages about 21 inches. During June through September, it is almost rainless. The rainfall is fairly well distributed throughout the winter months, usually occurring in steady but general 2- to 3-day storms. During the rainy season there are periods of fair weather when the temperature rises and conditions are satisfactory for agricultural operations. Heavy fogs are common during the winter months; in extreme incidences they continue for several weeks. Thunderstorms, hail, and snow rarely are experienced in the county.

North winds of varying velocities are frequent throughout the year. They occur at intervals of from 1 to 3 weeks during the summer and less frequently during the winter. A summer north wind, which is very hot and desiccating, usually lasts 2 or 3 days. Rarely will a north or east wind bring rainstorms. The winds from the southeast are the rain winds in the winter and the cooling ones in the summer.

ANNUAL TEMPERATURES AND RAINFALL

MONTH	TEMPERATURE MEAN °F		MONTHLY MEASUREMENT INCHES STATION – RAINFALL		
	Maximum	Minimum	Marysville	Nicolaus	Tisdale
January	53	37	3.74	3.14	2.99
February	59	40	3.63	3.00	2.97
March	66	44	2.83	2.47	2.03
April	73	48	1.68	1.49	1.44
May	81	53	.79	.68	.57
June	89	58	.21	.17	.21
July	96	61	.01	.00	.00
August	95	59	.03	.03	.03
September	91	56	.09	.11	.12
October	79	49	1.17	.88	1.02
November	66	42	2.22	1.81	1.80
December	55	38	4.32	3.80	3.37
Yearly Measurement	76	48	20.72	17.58	16.55

FREEZE DATA 1921 - 1950

	COLUSA BRIDGE					MARYSVILLE					SACRAMENTO AIRPORT				
Freeze threshold temperatures F	32	28	24	20	16	32	28	24	20	16	32	28	24	20	16
Mean date of last spring occurence	2 20	1 23	1 7	x	x	2 15	1 16	1/3	x	x	1/24	1/8	x	x	x
Mean date of first fall occurence	11 25	12 18	12 28	x	x	11/26	12 18	x	x	x	12/11	12/26	x	x	x
Mean no. of days between dates	278	329	355	x	x	284	335	x	x	x	321	353	x	x	x
Years of record spring	29	28	28	28	28	27	26	26	26	26	30	30	30	30	30
No. of occurences in spring	29	21	8	2	0	27	17	5	1	0	26	10	3	0	0
Years of record fall	30	30	30	30	30	28	28	28	28	28	30	30	30	30	30
No. of occurences in fall	29	18	5	2	1	26	15	4	2	1	23	9	2	1	0

WATER SUPPLIES

The sources of water supply for Sutter County are direct precipitation, tributary surface, subsurface inflow, and surface canal imports for irrigation.

PRECIPITATION

Sutter County lies within the southern fringe of storms which periodically sweep inland from the north Pacific during the winter months. Although the rainfall resulting from these storms is moderate on the average, precipitation provides a substantial portion of the water supply for the area.

RUNOFF

Runoff from the highly productive watersheds surrounding the Sacramento Valley constitutes the most important source of water supply available to Sutter County. The Sacramento, Feather, Yuba, and Bear Rivers were diverted for irrigation purposes. Flood control and water storage dams were constructed on all of these major streams. Further development for irrigation purposes and the export of water to other parts of California will tend to stabilize the flow by reducing the peak uncontrolled flows in the winter months and increasing the water available for release during the summer months.

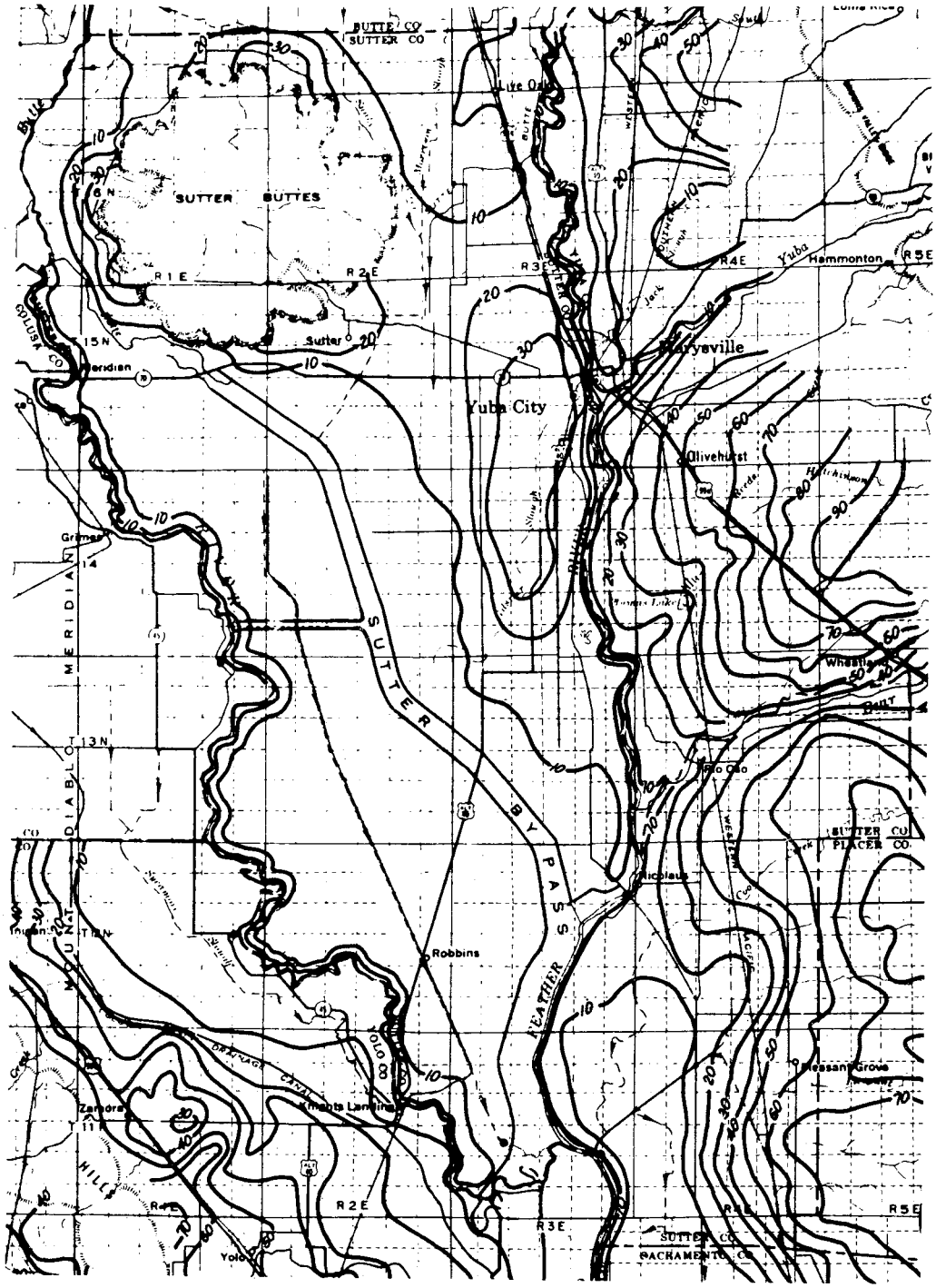
Water imported to Sutter County by the Sutter Butte Canal system is diverted from the Feather River 14 miles upstream from the north boundary of the area. Water for irrigation in the South Sutter Water District is diverted at the Camp Far West Dam. All other important diversions of surfaced water are made within the county.

UNDERGROUND HYDROLOGY

Sutter County overlies a portion of the ground water basin of the Sacramento Valley, and water pumped from storage in the basin serves as an important source of irrigation water. Ground water depth contours are shown in figure 1. Measurements by various agencies indicated little increase in depth to free ground water in the county, with the exception of the south Sutter area where surface waters are being developed to supplement the ground water. This decline in ground water level should diminish. Very little utilization is made of ground water the American and Sutter basins.

QUALITY OF WATER

The surface water supply from the Feather, Sacramento, Yuba, and Bear Rivers is of excellent mineral quality and well suited for irrigation. In ground water supplies, however, salinity sufficient to impair its use for irrigation, domestic, and many industrial uses has been observed from scattered wells throughout the area for many years. In the areas underlying the Sutter Basin and south of Oswald road and east of the Sutter bypass, the salinity of ground water has been general, and an abnormally high concentration of chloride is found in many of these wells. The appearance of chloride salinity is thought to be due to an apparent mixture of deep-seated brines with native fresh ground waters. There is evidence such brines may underlie aquifers of good quality throughout the large areas of the Sacramento and San Joaquin Valleys. They may have originated when the floor of the valley was inundated by the ocean.



DEPARTMENT OF WATER RESOURCES
DELTA BRANCH

LINES OF EQUAL DEPTH
TO WATER IN WELLS

FALL OF 1963

SCALE OF MILES
1 0 1 2 3 4 5 6 7

Figure 1. Ground water depth contours.

IRRIGATION DEVELOPMENT

Many major water diversions are made by irrigation districts from the major streams in the area. These waters are transmitted to contracting farmers. Minor surface diversions are made for the most part by individuals whose lands are adjacent to the surface supplies.

PRINCIPAL WATER SERVICE AGENCIES — SUTTER COUNTY

Agency	Source of Water Supply
Butte Slough Irrigation Co. Ltd.	Butte Slough & Sutter Bypass
Feather River Water Company	Feather River
Garden Highway Mutual Water Company	Feather River
Meridian Farms Water Company	Sacramento River
Natomas Central Mutual Water Co.	Sacramento River
Natomas Northern Mutual Water Co.	Sacramento River
Oswald Water District	Feather River
Sutter Extension Water District	Feather River
South Sutter Water District	Bear River
Sutter Mutual Water Company	Sacramento River
Tudor Water District	Feather River
Tisdale Irrigation & Drainage Co.	Sacramento River

METHODS

Irrigation practices are determined by characteristics of the soil: texture, structure, uniformity, depth, and slope. Irrigation water may be applied on the surface or by artificially raising the ground water table (subirrigation).

Methods of surface irrigation are border, contour, furrow, and sprinkler. Border irrigation is a method of applying water to land between parallel ridges or borders. This method is popular in field crops and orchards. Strips of land between adjacent borders have little cross slope but have a grade in the direction of irrigation.

Contour irrigation is a modification of this method in which levees are placed along the contour and the water is ponded within individual checks. After a certain length of time the water is passed to the next lower check. Orchards and some forage and field crops frequently are irrigated using this system.

Furrow irrigation is a popular method for row crops and orchards. The water is run in small streams in ditches or furrows between the crop rows; it soaks into the soil and spreads out into the crop root areas between the furrows.

Sprinkler irrigation is preferred on uneven or rough lands with variable soil conditions, often where the soil is very sandy. Sprinklers may be useful where the flow of water is not large enough to permit efficient surface irrigation.

Subirrigation is the method of artificially raising the water table. It is utilized extensively in the Sutter Basin in producing crops such as beans, tomatoes, and safflower. It is adaptable to a number of other crops, but for success it requires water free from salts, soil relatively free from salinity or alkali, flat slopes, and an impervious layer or clay layers which encourage the lateral movement of water. The water table in subirrigated areas should be relatively high at the start.

FLOOD CONTROL AND DRAINAGE

Flood protection and drainage of agricultural lands are offered by a number of publicly supported districts. Important among these are the districts organized under the provisions of the California Reclamation District Law. Portions of Sutter County also are within the bounds of the Sacramento and San Joaquin drainage district which comprises practically all of the swamp and overflow lands of the Sacramento and San Joaquin Valleys. This large district was formed in 1911. Two levee districts in Sutter County, organized during the period of early agricultural development, built levees to protect eastern Sutter Basin lands. The Sutter bypass and levees of the Feather, Yuba, and Sacramento Rivers are part of the Sacramento River Flood Control Project.

The function of the Sutter bypass is to receive and convey excess flood waters of the Sacramento River and Butte Slough through the the Sutter Basin. Support of these drainage districts is provided by taxation of the landowners within the district.

AGRICULTURE

Sutter County, sometimes called the Peach Bowl of the World, is noted for its production of rice and other field crops as well as fruit crops. The lands along the river generally are devoted to intensified orchard production, important among which are peaches, walnuts, almonds, and prunes. There is limited production of pears and market plums. Lands somewhat more removed from the river and shallower in depth generally are devoted to field and vegetable crops, such as sugar beets, tomatoes, asparagus, grain sorghum, wheat, barley, oats, irrigated pasture, safflower, alfalfa, and beans. Basin lands are used principally for the production of field crops; rice, wheat, safflower, and sorghum are among the most important.

The older terrace soils in the southeast portion of the county generally are devoted to rice, irrigated pasture, and dryland cereals. The upland soils of the Sutter Buttes are used for native range. Livestock, including poultry, plays a secondary part in the agriculture of the county. Some beef and sheep are grazed in the Buttes, and important dairy and poultry production enterprises are scattered throughout the county.

Peaches

The principal fruit produced in the county is peaches. They occupy large acreages of Gridley, Wyman, and Columbia soils along the Feather and Bear Rivers. The best soils are at least 4 feet deep, to minimize drainage problems due to heavy winter rainfall or improper irrigation practices. These peaches are principally clingstone varieties grown exclusively for canning. Yields range from 10 to 25 tons per acre during the 15-year bearing life, after 4 years required to begin bearing.

Alfalfa

Alfalfa is produced in the moderately deep soils, such as Gridley and Landlow. Commercial stands usually last 4 or 5 years and produce 5 or 6 cuttings per season. Yields range from 5 to 7 tons per acre. The land is leveled and levees constructed to provide proper irrigation and drainage. Sulphur and phosphorus fertilizers sometimes are applied at time of planting.

Walnuts

Walnuts are adapted to the deep alluvial soils, such as Columbia, Sycamore, and Wyman along the Sacramento and Feather Rivers. Some acreage also is planted on the river overflow lands subjected to winter flooding. Walnuts on black walnut rootstock are quite susceptible to crown rot or wet feet. The crop is irrigated and fertilized and should yield approximately 2,000 pounds per acre.

Prunes

Prunes occupy a relatively large acreage in the county. Production is best on deep well-drained soils, but prunes will grow satisfactorily on soils somewhat shallower and of heavier texture than those required for peach and almond production. Most of the prunes are grown on Gridley and Landlow soils. Yields generally range from 1½ to 2½ tons of dry prunes per acre.

Pears

Limited pear acreage is planted on recent alluvial soils (Columbia, Wyman) along the Feather River.

Plums

Plums for fresh market are similar to prunes in soil requirements, but generally are planted only on the deep well-drained soils, such as Columbia and Wyman. The crop is susceptible to frost and hail injury.

Vegetable crops

There is limited production of vegetables, such as melons, beets, onions, carrots, and occasionally other crops for seed and fresh market. These are adapted to the moderately deep soils and generally are planted on the Columbia, Gridley, and Landlow series.

Sugar Beets

Sugar beets are planted on the moderately deep soils, such as Gridley, Landlow, and Marvin. The crop is fertilized intensively and irrigated. Yields are near 20 tons per acre.

Tomatoes

Tomatoes are planted for surface irrigation on the deep to moderately deep alluvial soils, such as Gridley, Columbia, and Wyman, and also may be planted for subirrigation in the Sutter Basin on Marvin and Sacramento series. The crop is fertilized heavily, and yields range from 18 to 40 tons per acre.

Asparagus

Asparagus has found a place in the moderately deep soils, such as Gridley and Wyman around Tudor. Because asparagus is cut during the rainy season, February through May, well-drained soils with adequate surface slopes are best suited.

Grain Sorghum

Grain sorghum is grown extensively throughout the county on all soil series. It generally is irrigated and heavily fertilized. Yields range from 4,000 to 8,000 pounds per acre.

Small Grain

Large acreages of wheat, barley, and oats are grown in the county. Barley, the leading cereal, is planted throughout the county on most of the soil series. Wheat is planted extensively in the American and Sutter Basins. Wheat and oats are more suitable than barley on the San Joaquin and Kimball soils in the southeastern portion of the county. The cereal crops are fertilized but generally not irrigated.

Beans

Dry beans, including baby limas, pinks, reds, and red kidneys, are produced in the county. Baby limas are grown principally in the northern Sutter Basin on subirrigated soils of the Marvin and Sacramento series. The other colored beans are grown in the Sutter Basin and in the recent alluvial soils along the Sacramento, Feather, and Bear Rivers, such as Columbia, Sycamore, and Tujunga.

Rice

Rice is grown extensively in the Sutter and American Basins. It is adaptable to any of the soils with limited drainage. Marvin, Freeport, Sacramento, San Joaquin, Landlow, and Stockton soils are major soils for this crop. Water requirements are high, 7 to 8 acre-feet per acre. Large quantities of nitrogen fertilizers are used. Yields generally exceed 5,000 pounds per acre.

Almonds

Almonds are planted on moderately deep, well-drained soils, such as Sutter, Columbia, Wyman, and Gridley. They generally are irrigated, although there is some production of nonirrigated almonds near the Sutter Buttes. Almonds are one of the earliest blooming tree crops. Frost is therefore a problem, and orchards should be located in areas of good air drainage. While almonds will grow on some of the heavier, wetter soils with proper rootstocks, yields are reduced.

Irrigated orchards will range in yield from 1,500 to 4,000 pounds per acre of in-shell almonds. Dryland yields are near 1,000 pounds per acre.

Hops

A limited acreage of hops is planted on the Wyman and Columbia soils, principally near the Bear River and south of Tudor.

SOILS

Twenty-two different soil series were mapped in this reconnaissance soil survey.[1] These series differ from one another in the thickness, color, reaction, and texture of the major horizons within the profile. (A soil profile is a section vertical to the underlying material from which the soil forms. A soil horizon is a horizontal layer in the section.)

Directly or indirectly, the differences in the characteristics of the soil series are related to differences in factors of soil formation. These factors are the parent material from which the soil developed, the kinds of vegetation growing on the soil, the climate of the area, the length of time during which soil formation has taken place, and the shape of the land surface.

With the exception of the soils in the uplands of the Sutter Buttes, all of the soils in Sutter County developed on alluvium or river deposits. Most of the alluvium was deposited by four major rivers – the Sacramento, Feather, Yuba, and Bear. These rivers carried soil material from the uplands of the Sierra Nevada, Cascade, and Coast Range Mountains and deposited it on the flood plains and in the basins of Sutter County during flood stages. The soil materials in these mountain areas developed from sedimentary, volcanic, granitic, and metamorphic rock. As a result, most of the alluvial material from which the soils in Sutter County developed was derived from a mixed rock source.

The kinds of plants growing in Sutter County have changed considerably since white man arrived and cultivated his crops. Many of the original plants have disappeared, yet the darker colored surface soil in the county is the result of organic matter accumulation from the native vegetation. The darker soils are in the basins where a favorable combination of conditions existed for the accumulation of organic matter—that is, a moist clay soil with a dense growth of vegetation. Organic matter from hardwoods, shrubs, and grasses darkened the surface horizons of the deep soils along the rivers. A very slight amount of organic matter accumulated in the soils on the terraces and in the uplands where conditions for plant growth were less favorable.

[1] If a more detailed soil survey is made of this area, some of the soil series names may be changed.

Soils in Sutter County are associated with certain topographic features or land forms. A grouping of soil series by the three major land forms — basins, fans, and terraces — is shown in this table.

BASINS	FANS AND FLOOD PLAINS	TERRACES
Alamo	Columbia	Chualar
Freeport	Colusa	Kimball
Glann	Gridley	Placentia
Hildreth	Ramada	San Joaquin
Landlow	Sutter	
Marcuse	Sycamore	
Marvin	Tujunga	
Nicolaus	Wyman	
Sacramento		
Stockton		

The basin areas are relatively flat and have a moderately high water table most of the year. These areas probably were shallow lakes which were filled with fine sediments from the overflow of the major streams. A long, narrow flood plain was built across the Butte Sink and Sutter Basin by the Sacramento River. To a lesser extent, the Feather River built a flood plain across the Sutter and American Basins. Deep, medium-textured soils occur on these flood plains. The river channel was built up near the middle of the flood plains so that the alluvial deposits slope down and out from the river. Soils on the outer edge of the flood plain are underlain by the basin clay soils.

Most of the area in the eastern part of the county was covered at one time with an alluvial material which has partly eroded. The San Joaquin and Kimball series, which are some of the oldest soils in the county, occur on remnants of this material. The substratum of this older alluvium is cemented to a soft siltstone or sandstone. Soils of the Gridley, Landlow, and Stockton series developed in alluvium deposited over this eroded, cemented substratum.

The longer a soil parent material is exposed to weathering, the greater the differences become between the horizons within the profile. This is particularly true of the amount of clay in the horizons. The clay percentage in the subsoil will increase as the soil becomes older. For instance, the Columbia soils developed in recent alluvial deposits and have no noticeable horizons, although they are stratified. The Kimball soils, on the other hand, which occur on older terraces, have very pronounced clay subsoils. The soils in Sutter County can be grouped according to the characteristics of the profile with respect to the amount of clay in the subsoils, or whether they are clays throughout. The soil series in each of the groups is as follows:

Soil profiles with clay throughout: Marvin, Sacramento, Freeport, Glann, Nicolaus.

Soil profiles with clay throughout and underlain by a sandstone: Landlow, Marcuse, Stockton, Hildreth, Alamo.

Soil profiles with no increase in clay: Columbia, Colusa, Sycamore, Ramada, Tujunga.

Soil profiles with a slight increase in clay in the subsoil: Sutter, Wyman.

Soil profiles with a moderate increase in clay in the subsoil: Gridley, Chualar, Glann.

Soil profiles with a maximum amount of clay increase in the subsoil: Placentia, Kimball.

Soil profiles with a maximum amount of clay increase in the subsoil underlain by hardpan: San Joaquin.

LAND CLASSIFICATION

Soils frequently are grouped according to certain land use properties. For instance, soils might be grouped into different classes according to their irrigability. Or they might be placed into groups according to their inherent properties to produce a kind of crop. In this survey we made no attempt to make any of these kinds of groupings. Land classification surveys were made in the county by the Bureau of Reclamation and the California Department of Water Resources.

Soil information frequently is used in land appraisals and land valuation. The soil survey information provided by this soil survey is not of sufficient detail to be used for this purpose, but it can be used as a basis for a more detailed soil survey on a particular farm.

METHODS OF SOIL SURVEY

This reconnaissance soil survey combines all of the available soil and land classification information available in the county with field observations of soils in road cuts, ditch banks, and auger borings, and with aerial photographs. The Soil Survey of the Marysville Area, 1909, and the Reconnaissance Soil Survey of the Sacramento Valley, 1915, were the basic material used in this survey. For the most part, the soil series which were recognized in these earlier soil surveys also occur in this survey. The detailed soil survey made by the Soil Conservation Service in the southeastern part of the county also was incorporated in this survey. The U.S. Bureau of Reclamation and the California Department of Water Resources made land classification surveys over much of the county. This information also was used in preparing this soil map.

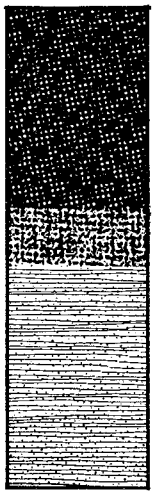
The detail of soil survey information provided by this reconnaissance survey is less than that found on detailed soil surveys being prepared in other parts of California. The information provided by this survey, however, provides the information necessary for the understanding of the soils in any of the areas in the county, with the exception of those in the Sutter Buttes. For detailed farm planning or detailed land management, it may be necessary to obtain more information on a particular area.

SOIL MAPPING UNITS

A soil mapping unit is an area delineated on the reconnaissance soil map. Each area contains a symbol designating the dominant soil or soils in the area. The soil mapping units are described as follows.

A – ALAMO SOILS

The Alamo soils are moderately shallow and poorly drained. They are dark-colored clays throughout and underlain by a cemented substratum. They have developed in small basins in old alluvial materials often associated with the San Joaquin and Kimball soils. All of these soils occur south and east of Nicolaus. All have been cultivated. Some are planted to cereals; others have reverted to range.



Variations:

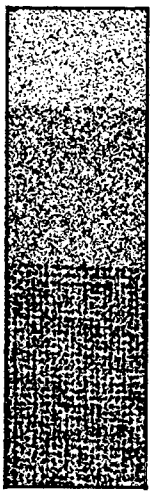
Soil depth to the cemented sandstone may vary from 12 inches to nearly 5 feet. In most profiles it occurs at about 24 to 30 inches. The calcareous clay layer above the cemented sandstone may or may not be present in all profiles. Included are small areas of Kimball soils which have a loam surface and a dense clay subsoil, as well as small areas of San Joaquin soils which are similar to the Kimball except have a cemented substratum under the clay. Water stands in these soils most of the winter months, and when irrigated they remain wet for long periods of time.

Soil Management Characteristics:

These are among the less productive soils in Sutter County. They are relatively shallow, fine textured, and tend to be poorly drained. The areas are generally small, which makes them difficult to manage with the surrounding medium-textured soils.

Ch – CHUALAR SOILS

The Chualar soils are deep and well drained. They have sandy loam surface soils and sandy clay subsoils. These soils have developed from alluvium derived from rhyolitic volcanic rock, and occur on terraces around the Sutter Buttes. Most of the soils have been cultivated. Some are planted to almond orchards; others to milo and irrigated pastures.



Variations:

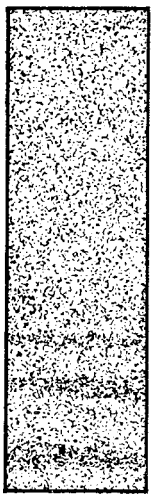
Included are areas of Sutter soils which are sandy loams to loams throughout. Also included are areas of the Placentia soils which have a relatively dense clay subsoil, as well as areas of the Hildreth soils which are dark clays throughout.

Soil Management Qualities:

The Chualar soils are good, easy to manage, and crops grow fairly well in them. They are well drained with only a slight restriction in the profile to roots and water penetration. The coarse sand particles in the soils are rather abrasive and cause excessive wear on cultivation equipment. The soils are hard when dry and excessive cultivation tends to accentuate this undesirable characteristic.

Cm – COLUMBIA SOILS

The Columbia soils are deep and moderately well drained. They may be stratified but are often medium textured throughout. The alluvium on which these soils occur was derived from many kinds of rock. They are on the recent flood plains of the Sacramento and Feather Rivers. Most of this soil is cultivated, although some areas of this soil not protected from flooding by levees are used for summer cattle range.



Brown loam, fine sandy loam or silt loam, neutral in reaction. Some profiles may be stratified. Reddish-brown and yellow mottling, which is due to water standing in the soil, occurs below 3 feet in profiles.

Variations:

Gravel layers occur under some areas near the rivers. Clay layer may occur under areas where the Columbia soils join with those of Sacramento or Freeport soils. Hardpanlike areas occur under other areas of Columbia soil, particularly where they join with San Joaquin soils. Small areas of Colusa soils which contain alkali may be included. The grayer Sycamore soils and the very mottled and stratified Ramada soils also may be included. The water table fluctuates considerably during the year. In most areas it is more than 5 feet except for short periods during the winter.

Figure 2. Young peaches interplanted with pumpkins on Columbia soils in Gilsizer Slough.

Soil Management Qualities:

This is one of the good soils in Sutter County. Where the water table is over 5 feet and when protected by levees from flooding, it is one of the best soils. The soil surface may be somewhat uneven due to abandoned stream channels.

$\frac{Cm}{C}$ – COLUMBIA SOILS OVER CLAY

The Columbia soils were deposited over several of the clay soils in the Sutter and American Basins. These areas, for the most part, are shown on the map as Columbia over clay when the clay occurred at a depth of less than 5 feet in the profile. The Columbia soil material above the clay is very similar to that of Columbia soil.

Soil Management Qualities:

These areas are more difficult to manage for good crop production because water will stand in the Columbia soils above the clay for relatively long periods of time after an irrigation or a rain. Roots of many crops are injured when water stands in the soil profile for extended periods of time.

Cm (wet) – COLUMBIA SOILS, WET

This area of Columbia soils occurs in Gilsizer Slough where it meets the Sutter bypass. In this area the water table stands at a relatively shallow depth in the soil most of the year.

Soil Management Qualities:

The high water table in this area will damage the roots of many crops. During the winter part of the area is flooded. Unless drainage is provided for this area, land management will be restricted.

$\frac{CmRa}{C}$ – COLUMBIA AND RAMADA SOILS OVER CLAY

The Columbia and Ramada soils were deposited in a rather complex pattern over clays of Sacramento and Marcuse soils. The dense clays occur at a depth of less than 5 feet in most of these profiles.

Soil Management Qualities:

Water, which stands in these profiles after irrigation or a rain, will limit the root growth of most plants. As a result, only a few kinds of plants do well in these areas.

CmS – COLUMBIA SOILS, SALINE-ALKALI

These soils have profiles similar to those of Columbia soils. They contain slight to moderate amounts of salts and absorbed sodium which affect plant growth. Included are areas which have saline and alkaline content below that which affects most plants. Seepage from the Feather River aggravates this condition.

Soil Management Characteristics:

Kinds of crops grown on this soil are determined to a large degree by the amount of salinity and alkalinity of the soil. Growth of crops less tolerant to salinity-alkalinity is spotty.

CmSy – COLUMBIA-SYCAMORE SOILS

The Columbia and Sycamore soils along the Sacramento and the lower Feather Rivers are associated in such an intricate pattern that it was not convenient to separate them in this soil survey. Each of the soils is described more thoroughly under its own name.

Soil Management Qualities:

Most crops grown in the area, except rice, do well on these soils. Plant growth may be limited in a few areas where there is a moderate amount of alkali or where the water table fluctuates at depth of less than 5 feet.

CmTj – COLUMBIA-TUJUNGA SOILS

These soils occur together along the Feather River. In this soil survey it was not convenient to separate the long, narrow stringers of these soils. Refer to the Columbia and the Tujunga soils descriptions for more information.

Soil Management Qualities:

The native hardwood vegetation has not been cleared from some of these areas. Some areas are not protected by levees, and as a result often are flooded during the winter. The relief through the area is quite varied because of the many stream channels. Soil textures often vary from sand to silt loam in short distances.

CHARACTERISTICS OF SOILS IN SUTTER COUNTY

SOILS	MAP SYMBOLS	SURFACE HORIZON (A HORIZON)				SUBSOIL HORIZON (B HORIZON)				SUBSTRATUM HORIZON (C HORIZON)			PARENT MATERIAL	LAND FORM	DOMINANT CROPS	DRAINAGE
		THICKNESS	COLOR	TEXTURE	REACTION	THICKNESS	COLOR	TEXTURE	REACTION	COLOR	TEXTURE	REACTION				
Alamo	A	12" to 60"	very dark gray	clay	neutral	same as surface				softly cemented sandstone			mixed alluvium	basin	cereals	poor
Chualar	Ch	15" ±	brown	loam	neutral	15" ±	brown	clay loam	neutral	brown	sandy loam clay loam	slightly alkaline	rhyolitic alluvium	terrace	cereals orchards	well
Columbia	Cm	many feet	brown	loam	neutral	same as surface							mixed alluvium	flood plain	orchards row	moderately well
Colusa	Cs	24" ±	gray brown	silty clay loam	alkaline	over 5'	brown	silty clay loam	alkaline	same as subsoil			mixed alluvium	basin rim	cereals	moderately well
Freeport	F	24" ±	very dark gray	clay	neutral	44" ±	dark brown	clay	calcareous	light brown	clay loam	calcareous	mixed alluvium	basin	rice	poor
Glann	Gl	20" ±	dark gray brown	clay loam	neutral	over 5'	gray brown mottled	clay	mildly alkaline	same as subsoil			mixed alluvium	basin	cereals	poor
Gridley	Gr	15" ±	brown	loam	neutral	48" ±	brown	clay loam	slightly alkaline	softly cemented sandstone			mixed alluvium	flood plain	orchards row	well
Hildreth	Hi	24" ±	very dark gray	clay	neutral	same as surface				softly cemented sandstone			rhyolitic alluvium	basin	cereals	poor
Kimball	Ki	15" ±	reddish brown	loam	slightly acid	36" ±	reddish brown	clay	neutral	reddish brown	clay loam	neutral	mixed alluvium	terrace	cereals	well
Landlow	L	15" ±	dark gray brown	silty clay loam	neutral	36" ±	dark brown	clay	alkaline	softly cemented sandstone			mixed alluvium	basin	cereals	imperfect
Marcuse	Mc	15" ±	dark gray brown	silty clay loam	alkaline	30" ±	very dark gray	clay	alkaline	softly cemented sandstone			mixed alluvium	basin	cereals	imperfect
Marvin	Ma	15" ±	dark gray brown	silty clay loam	neutral	40" ±	very dark gray	clay	alkaline	yellow brown	silty clay loam	alkaline	mixed alluvium	basin	cereals	imperfect
Nicolaus	Ni	12" ±	gray brown	clay	neutral	24" ±	light brown	clay	neutral	yellow brown	silty clay loam	alkaline	mixed alluvium	basin	cereals	well
Placentia	Pl	15" ±	brown	sandy loam	neutral	36" ±	reddish brown	clay	neutral	brown	sand clay loam	neutral	rhyolitic alluvium	terrace	cereals	well
Ramada	Ra	over 5'	brown, very mottled	variable	neutral	very stratified; may have Sacramento or Columbia soil in substratum							mixed alluvium	flood plain	orchards row	imperfect
Sacramento	Sa	20" ±	very dark gray	clay	neutral	48" ±	dark gray	clay	alkaline	yellow brown	clay	alkaline	mixed alluvium	basin	cereals row	poor
San Joaquin	Sj	15" ±	brown	loam	slightly acid	24" ±	reddish brown	clay	neutral	(Hardpan) softly cemented sandstone			mixed alluvium	terrace	cereals	well
Stockton	Sca	20" ±	very dark gray	clay	neutral	36" ±	dark gray	clay	alkaline	softly cemented sandstone			mixed alluvium	basin	cereals	poor
Sutter	Su	15" ±	brown	sandy loam	neutral	over 5'	brown	loam	neutral	same as subsoil			rhyolitic alluvium	alluvial fan	orchards row	well
Sycamore	Sy	20" ±	gray brown	silty clay loam	moderately alkaline	over 5'	light gray brown	silty clay loam	calcareous	same as subsoil			mixed alluvium	flood plain	orchards row	moderately well
Tujunga	Tj	12" ±	pale brown	sand	slightly acid	over 5'	very pale brown	sand or loamy sand	neutral	same as subsoil			mixed alluvium	flood plain	orchards row	excessive
Upland	Up	Upland soils in Sutter Buttes not mapped; however, a discussion of the soils is in the report														
Wyman	Wy	20"	dark brown	loam	neutral	over 5'	brown	clay loam	neutral	same as subsoil			mixed alluvium	flood plain	orchards row	well

CmTjRa – COLUMBIA-TUJUNGA-RAMADA SOILS

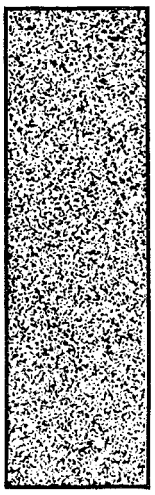
These three soils occur in a rather complex pattern along the Bear and Feather Rivers. The Columbia and Tujunga soils which occur in this area were partly covered by the Ramada soils at the time of the hydraulic mining in the Sierra Nevada Mountains. It was not practical to separate the soils in this survey.

Soil Management Qualities:

Most of the area is still covered by a rather dense growth of native vegetation. Little or none of it is cleared for more intensive land use. The areas are quite variable as to soil texture and relief.

Co – COLUSA SOILS, SALINE-ALKALI

The Colusa soils are deep with a fluctuating water table and contain alkali. They are clay loam or silty clay loam throughout. These soils occur in recent alluvium deposited by the Sacramento and Feather Rivers along the edge of the Sutter Basin. Most of the soils are cultivated and cropped to grain, rice, or sugar beets.



Gray-brown silty clay loam, alkaline.

Brown silty clay loam, alkaline.

Variations:

The amount of alkali these soils contain varies from slight to moderately high, enough to adversely affect the growth of most crops. Included are some areas of Sycamore and Columbia soils which contain little or no alkali, and areas of Sacramento soils which are clay throughout. The water table may stand at less than 5 feet in some areas.

Soil Management Qualities:

The alkali problem (exchangeable sodium) in these soils limits the growth of most crops. Crop growth generally is quite variable due to the variation of alkali. Water penetrates the soil very slowly because the sodium has caused the clay to run together.

CoSy – COLUSA-SYCAMORE SOILS, SALINE-ALKALI

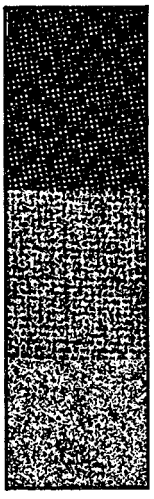
These two soils occur along the western edge of Sutter Basin in such complex pattern that it was not convenient to separate them in this soil survey. See the descriptions of the Colusa and Sycamore soils for more information.

Soil Management Qualities:

To a large extent, the crops grown in this area are limited to those tolerant to the alkali conditions of the Colusa soils. Fields of less tolerant crops are very spotty.

F – FREEPORT SOILS

The Freeport soils are deep and poorly drained. They are dark clays throughout, and formed in alluvium deposited in basins by streams draining the Sierra Nevada Mountains. All of the soil is cultivated and planted mainly to rice.



Very dark-gray clay, medium acid to neutral.

Dark-brown clay, neutral to moderately alkaline (calcareous).

Light-brown clay loam, moderately alkaline (calcareous).

Variations:

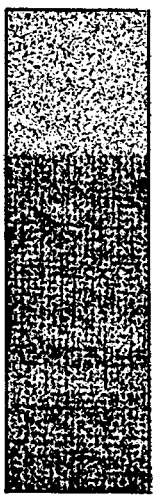
Included are areas which have a cemented sandstone under the soil at depths ranging from 3 to 5 feet. There also are areas of Glann soils which have a clay loam surface and clay subsoils. Also included are small areas of San Joaquin soils which have a loam surface soil, a clay subsoil, and a cemented sandstone substratum, and Alamo soils that are dark-gray clay over a cemented substratum. Along the Sacramento River some of the Freeport soils are covered with a thin layer of Columbia loam soil. Most of the soil profiles have a water table standing at depths from 3 to about 6 feet.

Soil Management Qualities:

This is one of the best rice soils in the south Sutter area. Very few other crops are grown in the soil because of the fine texture and the relatively high water table. The clays of the Freeport soils appear to be a little more difficult to manage than the clays of the Sacramento series, mainly because they contain more clay and are more dense.

Gl – GLANN SOILS

The Glann soils generally are deep with a fluctuating water table. They have clay loam surface soils and clay subsoils, and may have cemented sandstone under them. The soils developed in alluvium deposited along the edges of basins by streams draining the Sierra Nevada Mountains. All of the soil is cultivated and planted to cereals, including rice, and to row crops.



Variations:

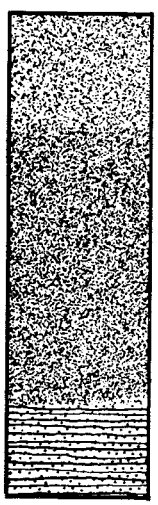
Depths of the surface soils may range from 10 to 24 inches. A cemented substratum may occur under the soil at depths ranging from 3 to more than 5 feet. Many profiles do not have the substratum within 5 feet. A water table is present in the soil much of the year. It ranges in depth from about 3 to more than 5 feet.

Soil Management Qualities:

This soil has a limited use because of the dense clay subsoil and the fluctuating water table. Cereals, as well as rice, and shallow-rooted row crops grow fairly well on this soil.

Gr – GRIDLEY SOILS

The Gridley soils are moderately deep to deep soils, underlain by a cemented substratum. They have medium-textured surface soils and moderately fine-textured subsoils. They occur on old alluvium deposited by rivers draining the Sierra Nevada Mountains. All the Gridley soil is cultivated and much of it is planted to orchards.



Variations:

The depth to the cemented substratum varies from about 30 inches to 8 or more feet, although in most profiles this layer occurs between 3 to 5 feet. The hardness of this layer also varies somewhat. The upper few inches generally are the hardest and most dense where it is the shallowest. Included are areas of Landlow, Wyman, Kimball, San Joaquin, and Stockton soils.

Figure 3. Asparagus planted on Gridley soils.

Soil Management Qualities:

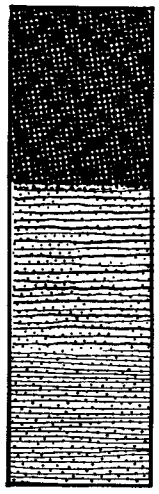
In general, this is one of the good soils in Sutter County. Orchard crops often are affected adversely in areas where the cemented substratum is shallow and hard. Most other deep-rooted crops will not grow well in these areas. These deep-rooted crops grow poorly in the included areas of Kimball, Landlow, Stockton, and San Joaquin soils. Soil compaction often results from traffic and tillage when this soil is wet.

Hi – HILDRETH SOILS

The Hildreth soils are moderately deep and imperfectly drained. They are dark clays throughout, underlain by a hard, cemented substratum. These soils developed in alluvium deposited in basins around the Sutter Buttes. All of these soils have been cultivated. Some are planted to grains; others have reverted to range.

Variations:

Depth to the cemented substratum varies from about 12 inches to nearly 5 feet. Water stands in most areas during the winter months. Included may be small areas of Placentia soils, which have sandy loam surfaces and clay subsoils, as well as small areas of Chualar, which have sandy loam surfaces and sandy clay loam subsoils.



Very dark-gray clay, neutral in reaction.

Softly cemented but brittle sandstone. The top of this layer is often very hard and would be referred to as a hardpan.

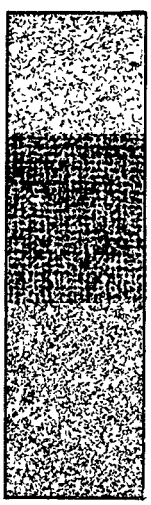
The lower layers may be less dense with a few pores.

Soil Management Qualities:

Because these soils stay wet for long periods during the winter and are relatively shallow, they have a low agricultural value. These clay soils are more difficult to manage than most of the clays in Sutter County. They are more dense and contain a small amount of coarse sand grains. These sand grains cause the soil to be rather harsh and cause excessive wear to cultivation equipment.

Ki – KIMBALL SOILS

The Kimball soils have moderately shallow surface soils favorable for plant growth. The surface soils are loam, the subsoils are dense clays, and the lower subsoils are clay loams. These soils occur on old alluvium deposited by streams draining the Sierra Nevada Mountains. Most of the soils have been cultivated and are planted mainly to grain, including rice, and to row crops



Variations:

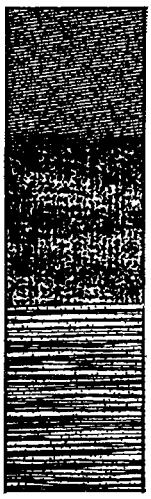
The thickness of the surface soils ranges from about 12 to nearly 24 inches. The clay subsoils range in thickness from about 12 inches to nearly 3 feet. Included are areas of San Joaquin soils which have a cemented sandstone under the clay. There also are areas of Nicolaus soils which are brown clays throughout. Also included are areas of Gridley soils which have a clay loam subsoil with a cemented sandstone substratum. In the Tudor area, the Kimball soils are brown throughout rather than reddish brown.

Soil Management Qualities:

The Kimball soils are one of the poorer soils in Sutter County. Only a few kinds of crops grow well in the soil because of the dense clay substratum at a relatively shallow depth. Roots and water penetrate this clay very slowly, so that water stands above the clay and causes damage to plant roots. However, some of the shallow-rooted crops, as well as rice, do fairly well on this soil when managed properly.

L – LANDLOW SOILS

The Landlow soils are moderately deep and imperfectly drained. They have moderately fine-textured surface soils and fine-textured subsoils. A cemented substratum occurs under the soil at about 3 feet. These soils formed in basin areas from alluvium deposited by streams draining the Sierra Nevada Mountains. All the Landlow soils are cultivated and cropped mainly to rice, sugar beets, milo, pasture, and some prunes.



Variations:

The depth to the cemented substratum varies from about 20 inches to 60 inches, but often is about 30 to 36 inches. A number of small areas are localized basins with no surface drainage, although surface drainage from most areas is slow into drainage ditches through the area. This soil remains wet during most of the winter.

Soil Management Qualities:

Most deep-rooted crops or crops requiring a well-drained soil do very poorly on this soil. Peach trees, for instance, are not able to survive many years' growth on Landlow soils, although crops such as cereals, rice, and many row crops do very well. Frequently these soils are cultivated too wet because they stay wet longer than adjoining areas of Gridley soils. As a result, they often are compacted.

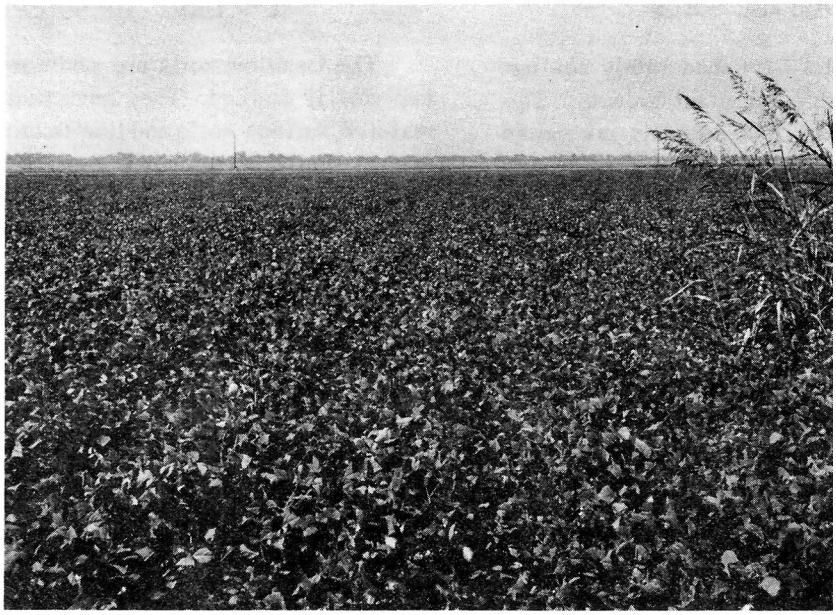
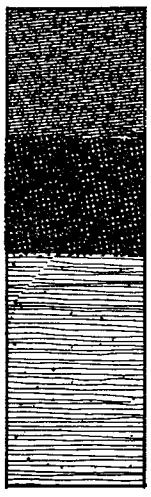


Figure 4. Beans growing in Landlow soils north of Sutter bypass and west of highway Cal. 99.

Mc – MARCUSE SOILS

The Marcuse soils are moderately deep and imperfectly to poorly drained. They are fine textured throughout and underlain by a cemented sandstone. These soils developed in alluvium deposited in the basin by the Sacramento and Feather Rivers. All of the soil is cultivated and planted mainly to rice and milo.



Variation:

Surface soil is more often a clay, but may approach silty clay loam. Soil depth to the cemented substratum varies from about 20 inches to nearly 5 feet, although more often it is between 24 and 30 inches deep. This substratum is relatively impervious to water, and very few roots penetrate it. A water table frequently stands in this soil, varying in depth from about 18 inches to 4 feet.

Soil Management Qualities:

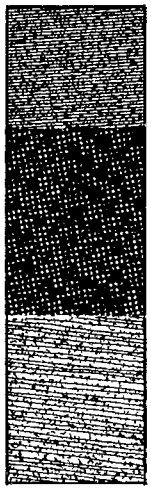
This is probably one of the less desirable soils in the Sutter Basin area, due primarily to the shallow depth to the cemented substratum, the shallow water table, and a nutritional problem associated possibly with salinity or alkalinity. Rice growth in particular is variable on this soil. Beans, as well as alfalfa, have been grown with a reasonable amount of success in a few areas.

Ma – MARVIN SOILS

The Marvin soils are deep, and imperfectly to poorly drained. They have silty clay loam surface soils and clay subsoils. The substratum often contains less clay than the subsoils. These soils developed in alluvium deposited in the basin by the Sacramento River. All of the soil is cultivated and planted mainly to rice, wheat, milo, and tomatoes.

Variations:

The surface soil in some areas approaches silty clay, and varies in thickness from 10 to 20 inches. The subsoils are always clay in texture and vary in thickness from 6 inches to more than 3 feet. Included are areas of Sacramento clays These soils generally are quite a bit darker than the Marvin soils. A few areas may be underlain by a cemented zone. This layer occurs below about 4 feet. Most areas will have a water table varying in depth from about 3 to 6 feet.



Dark-gray-brown silty clay loam, neutral to alkaline

Very dark-gray clay, alkaline (calcareous).

Yellow-brown, mottled, silty clay loam, alkaline (calcareous).

Soil Management Qualities:

This is one of the better soils in the area for cereals and row crops. Although the water table is relatively high in this soil, it is generally maintained at a constant level during the growing season so that it does not damage the roots of such crops as tomatoes and milo. There is no evidence that salinity or alkalinity will be a problem with this kind of management in this particular area. Fine-textured soils such as these can present some serious management problems, but if managed properly in relation to moisture, there is relatively no cultivation problem.

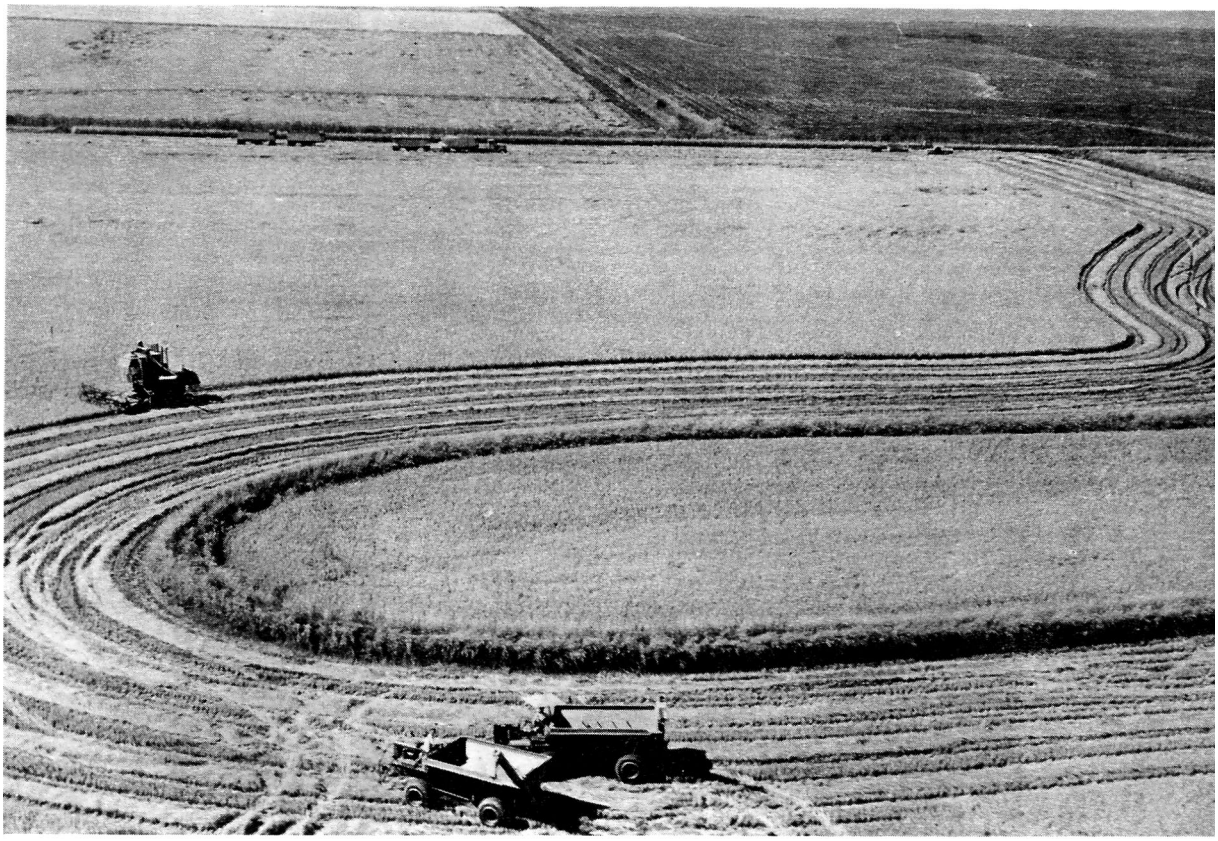


Figure 5. Harvesting rice from Marvin and Sacramento soils in the Sutter Basin.

MaS – MARVIN SOILS, SALINE-ALKALI

These soils have profiles similar to the Marvin soils but contain moderate amounts of salts as well as sodium. The water table in much of the area often is less than 3 feet below the soil surface.

Soil Management Qualities:

The saline-alkali condition in the soil, as well as the high water table, limits the growth of most crops Only part of the area is managed for crop production, the balance is used for hunting crops

Ni – NICOLAUS SOILS

The Nicolaus soils are deep and moderately well drained. They are clays throughout They developed in alluvium deposited along the edges of basins by the Bear and Feather Rivers. All of the Nicolaus soils are cultivated and planted to cereals, including rice, and to row crops A relatively small acreage is planted to prunes. (See figure 6)

Variations:

The depth of clay to the yellow silty clay loam substratum varies from 20 to 36 inches. Included are small areas of Kimball soil which have brown loam surface soils and dense clay subsoils There also are small areas of Glann soils which have gray-brown clay loam surface soils and dense clay subsoils. Also included may be areas of the dark-colored Freeport clays.

Soil Management Qualities:

The Nicolaus soils are only fair soils in Sutter County. Water does not drain well from these fine-textured soils, and they are more difficult to cultivate.

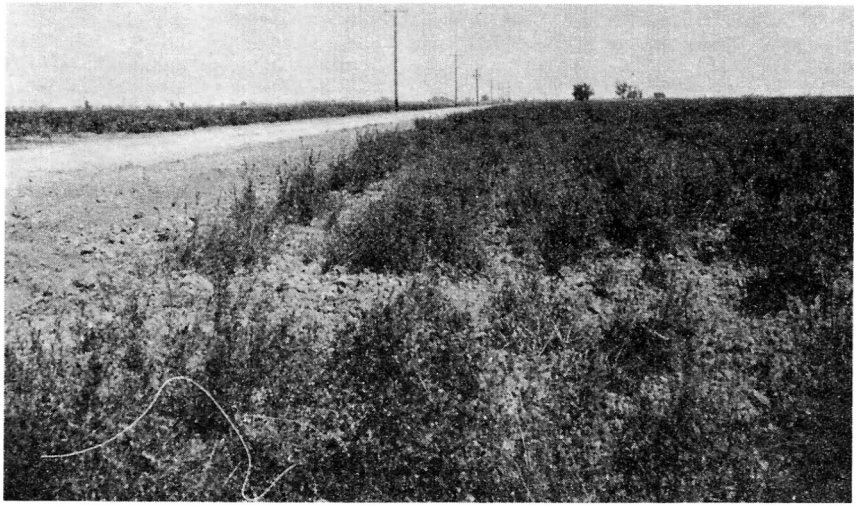
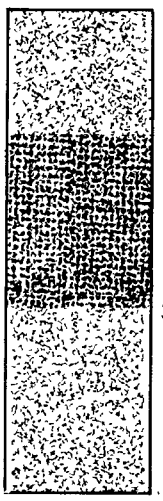


Figure 6. Alfalfa for seed and tomatoes growing in Nicolaus soils north of Sutter bypass and east of highway Cal. 113.

Pl – PLACENTIA SOILS

The Placentia soils have a relatively shallow surface soil favorable for plant growth The surface soils are sandy loam, the subsoils are a dense clay, and the substrata are quite variable but generally a sandy clay loam. These soils occur on old alluvium derived from rhyolitic rock in the Sutter Buttes. Most of the soils are cultivated and planted to grains and some row crops



Variations:

Included are areas of Chualar soils which have a less dense sandy clay loam subsoil, as well as areas of Hildreth soils which are clays throughout. Some of the soils in the narrow valleys in the buttes have either rock or cemented zones under them at depths of 2 to 5 feet.

Soil Management Qualities:

The Placentia soil is one of the poorer soils in Sutter County because of the relatively shallow surface soils and dense clay subsoils. Roots and water penetrate the clay very slowly. Crop roots can be damaged by water standing in the soil above the clay.

PlCh – PLACENTIA-CHUALAR SOILS

The Placentia and Chualar soils occur in close association on some alluvial fans around the Sutter Buttes In this survey it was not convenient to separate these soils. Each of the soils is described separately.

Soil Management Qualities:

In managing these areas, particular attention should be given to the presence of the Placentia soils, since they have the greatest limiting characteristics for good plant growth.

PlE – PLACENTIA SOILS, ERODED

An area of Placentia soils on the west side of the Sutter Buttes was partly eroded by the Sacramento River flowing into the Sutter bypass. The clay subsoils of the Placentia soils are exposed in many places, which results in very rough land.

Soil Management Qualities:

Most of the area is used for range. Before the area could be used for more intensive land use, the soil would have to be leveled and protected from future flooding.

PlHi – PLACENTIA-HILDRETH SOILS

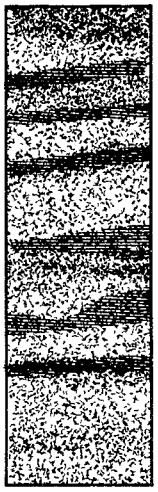
It was not convenient in this soil survey to separate these two soils. More information is given under the description of each soil.

Soil Management Qualities:

These soils are difficult to manage due to the clay surface of the Hildreth soils and the clay subsoil of the Placentia soils.

Ra – RAMADA SOILS

The Ramada soils are deep and imperfectly drained. They are medium to coarse textured, but very stratified. They developed in alluvium deposited along the Bear and Feather Rivers. This recent alluvium was washed from the Sierra Nevada Mountains during the hydraulic mining period of the late 1800's. Most of the soil is cultivated and planted to orchard and row crops.



Layers of soil material ranging from silt loams through sands, which vary in color from brown to strongly mottled browns and reddish browns, as well as yellowish browns. The transition from one layer to the next often is very abrupt. This sudden change in texture causes water to stand in the many layers in the profile, resulting in the high degree of mottling characteristic of the soil.

Variations:

The greatest variation is in the thickness and texture of the many strata. Often the Ramada soils are underlain by dense clays of the Sacramento soils, or the sands of the Tujunga soils, or the more uniform textured Columbia soils.

Soil Management Qualities:

The Ramada soils are relatively good. The high degree of stratification causes them to be somewhat imperfectly drained, which presents a management problem for some crops in some of the areas. Deep plowing will eliminate the stratification.

Ra/C – RAMADA SOILS OVER CLAY

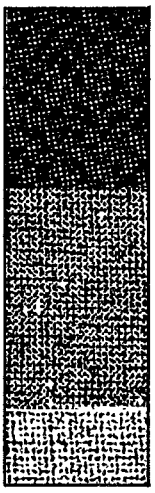
In an area in the lower end of the Sutter bypass, the Ramada soils were deposited over clays of Sacramento and Marcuse soils. In these areas the clay occurred at a depth of less than 5 feet. Water will stand above the clay subsoils, which can damage the root system of a number of crops.

Soil Management Qualities:

The kinds of crops grown on these soils are limited due to the clay subsoils.

Sa – SACRAMENTO SOILS

The Sacramento soils are deep and poorly drained, and fine textured throughout. These soils developed in alluvium deposited in a basin by the Sacramento and Feather Rivers. This is the predominant soil in the Sutter Basin. All of the soil is cultivated and planted mainly to rice, milo, and sugar beets.



Very dark-gray clay, neutral in reaction.

Dark-gray clay, alkaline (calcareous).

Yellow-brown, mottled clay, alkaline.

Variations:

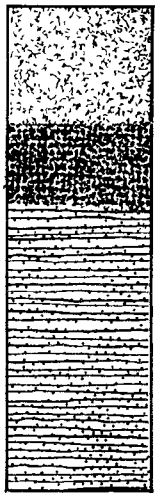
Marcuse soils also may be included. These soils have a cemented zone under them varying in depth from about 20 inches to 4 feet. Most areas have a water table varying in depth from about 2 to 4 feet.

Soil Management Qualities:

The Sacramento soils are some of the better soils in the Sutter Basin. Crop yields generally are high for those crops which can grow with a high but uniform depth water table. The clay texture of the soil makes it somewhat difficult to manage, but with the proper equipment and cultivated at the proper moisture, these soils can be prepared relatively easily.

Sj – SAN JOAQUIN SOILS

The San Joaquin soils have relatively shallow surfaces, favorable for plant roots The subsoils are dense clays underlain by a hardpan These soils occur on high terraces east of the Feather River, except for a few small areas south of Tudor and west of Live Oak Most of the soils have been cultivated. Some are planted to wheat, some to rice, others have reverted to pasture. See figure 7



Variations:

The thickness of the surface soil varies from about 10 to 24 inches, and the clay subsoil from about 6 to 20 inches The overall depth of soil above the hardpan varies from about 18 inches to nearly 4 feet, although most often the depth of soil to the hardpan is about 24 inches. The topography over the area is generally somewhat uneven. Small mounds and depressions over the area sometimes are referred to as a hog-wallow relief Under natural conditions these soils are well drained. When they are irrigated, water stands above the hardpan and above the clay, therefore, under irrigated conditions these soils can become imperfectly to poorly drained.

Soil Management Qualities:

Soils of the San Joaquin series are some of the poorer in Sutter County They are relatively shallow, and the relief is uneven. This cannot be corrected easily by leveling because of the possibility of exposing the hard substratum, and the soils show a tendency to be low in available phosphate The growth of most tree crops has not been favorable on the San Joaquin soils except in areas where the hardpan has been broken and the substratum is favorable for water drainage and root penetration

Figure 7. Drainage ditch through San Joaquin soils.

Sj (wet) – SAN JOAQUIN SOILS, WET

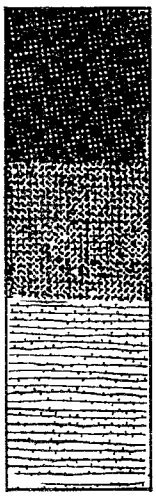
An area of San Joaquin soils in the southern part of the county has been affected by high water tables. The profiles of this soil are very similar to those of the San Joaquin, except that the color of the soil at the surface and the subsoils is brown rather than reddish brown.

Soil Management Qualities:

Crop and soil management is restricted by the hardpan under these soils and by the water table which often stands above this pan. Most of these areas are used for rice.

Sca – STOCKTON SOILS

The Stockton soils are moderately deep and poorly drained. They are fine textured throughout and underlain by a cemented sandstone. These soils developed in alluvium deposited in a basin primarily by the Feather River. All of the soil is cultivated and planted mainly to rice and milo.



Variations:

Soil depth to the cemented zone varies from 2 to 4 feet. Included are areas of Landlow soils which have a silty clay loam surface. There also are minor areas of Sacramento soils which do not have the cemented substratum. Also included may be narrow stringers of Gridley soils which have a brown loam surface. Most of these soils have a water table which ranges from about 2 to 4 feet deep.

Soil Management Qualities:

This is one of the fair soils in the basin areas in Sutter County. The shallow depth and relatively high water table and clay texture make this soil somewhat difficult to manage for very many crops. The clay texture is not too difficult to manage if it is worked with the proper equipment and at the proper moisture content.

Su – SUTTER SOILS

The Sutter soils are deep and well drained. They are medium to coarse textured throughout. They occur on young alluvium from rhyolitic rocks of the Sutter Buttes. All of these soils are cultivated and planted to row crops and orchards, mainly almond.

Variations:

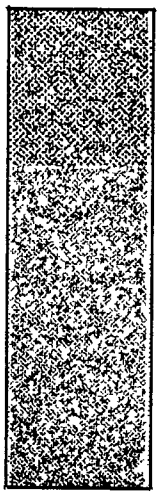
Included are areas of Chualar soils which have moderately dense, sandy clay loam subsoils, as well as small areas of Hildreth soils which are clay throughout. Small areas of Placentia soils which have a dense clay subsoil also may be included

Soil Management Qualities:

The Sutter soils are some of the best soils around the Sutter Buttes, because they are deep, well drained and medium textured throughout. The sand grains in the soil are rather coarse, however, and tend to cause excessive wear on cultivation equipment The soils also tend to bake rather hard when dry. Excessive cultivation accentuates this undesirable characteristic.

Sy – SYCAMORE SOILS

The Sycamore soils are deep and moderately well drained. They developed in alluvium deposited by the Sacramento River. All of the soil is cultivated and planted to cereal crops, row crops, and orchards.



Variations:

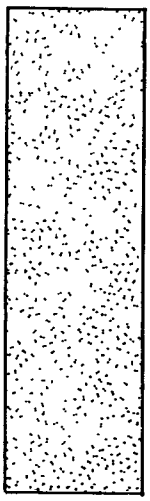
Included are some of the browner, medium-textured Columbia soils, as well as some of the alkali Colusa soils. Areas of Marvin soils which have clay subsoils also may be included. Although the mottling in the lower part of the profile indicates that water stands in the profile at times above 5 feet, most of the time the water table is deeper than 5 feet.

Soil Management Qualities:

The Sycamore soil is one of the better soils in Sutter County. It is deep, medium textured, and relatively well drained. A high water table causes problems in crop management in only a few places. Alkali in some instances causes a problem in the management of more sensitive crops.

Tj – TUJUNGA SOILS

The Tujunga soils are deep, well drained to excessively drained They are coarse textured throughout. These soils developed on recent alluvium deposited along the Feather and Bear Rivers. About half of the soils have been cultivated and planted to orchard and row crops. Some areas in the flood plains of the Feather and Bear Rivers have not been cleared of the dense growth of native vegetation, which consists of hardwoods and shrubs.



Variations:

The soils range in texture from sands to loamy sands and are generally quite stratified. Included may be areas of Columbia soils which are loams throughout, and Ramada soils which are very stratified and highly mottled.

Soil Management Qualities:

The Tujunga soils are rather droughty because of their very coarse textures. For this reason they are considered only a fair soil in Sutter County.

$\frac{Tj}{C}$ – TUJUNGA SOILS OVER CLAY

Clay occurs in the subsoils of these Tujunga profiles at a depth of less than 5 feet. In other respects the profile of the Tujunga is similar to that in the description. Water stands above the clay for relatively long periods after irrigation or a rain, which damages the root systems of a number of plants.

Up – UPLAND SOILS

We have not separated the soils in the uplands of the Sutter Buttes. All the soils are underlain by rock of varying hardness, and particular kinds of soils developed on each kind of rock. From a generalized geologic map of the Sutter Buttes, a soil parent material map was made. This map is shown in figure 8

The four general groups of soil parent material shown on the map are described in the following table.

GENERAL CHARACTERISTICS OF UPLAND SOILS

SYMBOL	KIND OF ROCK	SOIL DEPTH	DOMINANT SOIL CHARACTERISTICS
An	Volcanic rock and tuff	1' – 2'	loam soil
Ar	Volcanic flow rock	1' – 2'	stony loam soil
Sh	Shale and sandstone	2' – 4'	clay loam soil
Ss	Soft sandstone	5'	loam surface soil and clay subsoil

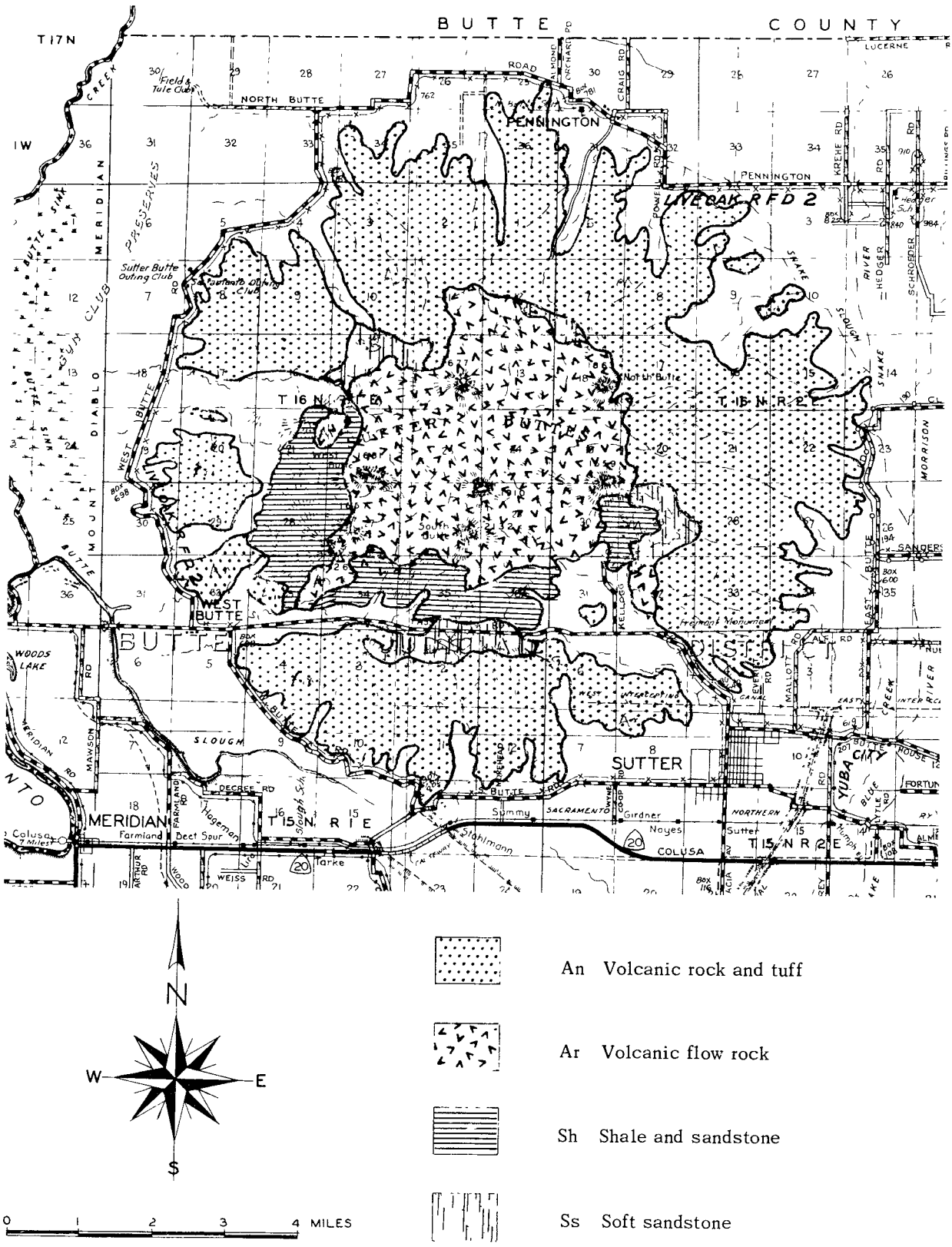
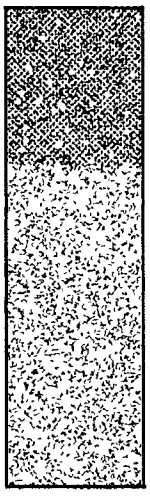


Figure 8. Parent material map for Upland soils in the Sutter Buttes (from California Division of Mines and Geology Bulletin 181 page 4)

Wy – WYMAN SOILS

The Wyman soils are deep, well drained and medium textured. They formed on alluvial deposits derived mainly from volcanic and granitic rock. These soils occur along the Feather River. All the soils are under cultivation and, in most areas, are planted to orchard crops. See figure 9.



Dark-brown loam or clay loam, neutral in reaction

Brown, near reddish-brown clay loam, neutral to moderately alkaline in reaction.

Variations:

Included are soils which are loam to sandy loam throughout. Small areas of Columbia, Gridley, Landlow, Honcut, and Kimball soils may be included.

Soil Management Qualities:

This is one of the best soils in Sutter County. Some of the best peach and walnut orchards are growing in this soil.

Figure 9. Prunes and walnuts growing on Wyman soils on highway 99 north of Wilson School.

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RECONNAISSANCE SOIL SURVEY

OF

SUTTER COUNTY, CALIFORNIA

Kenneth D. Gowans and John H. Lindt, Jr.

UNIVERSITY OF CALIFORNIA AGRICULTURAL EXTENSION SERVICE

1965

SCALE 1:62500

CONTOUR INTERVAL 5 TO 40 FEET
CONTOURS INCOMPLETE ALONG EMBANKMENTS AND DITCHES
DATUM IS MEAN SEA LEVEL

ROAD CLASSIFICATION

Heavy duty — Light duty
Medium duty — Unimproved dirt
U.S. Route — State Route

APPROXIMATE MEAN DECLINATION, 1954

LOCATION

Base map compiled from the United States Department of Interior Geological Survey 15 minute quadrangles, Butte City, Gridley, Sutter Buttes, Marysville, Dunnigan, Knights Landing, Lincoln, Davis and Fair Oaks surveyed 1952 - 1954.

A folder describing topographic maps and symbols is available from the U.S. Geologic Survey upon request.

This soil map is published from funds provided by the County of Sutter.

MAP SYMBOL	DOMINANT SOILS
A	Alamo soils
Ch	Chualar soils
Cm	Columbia soils
Cm/C	Columbia soils over clay
Cm (wet)	Columbia soils, wet
CmRa/C	Columbia and Ramada soils over clay
CmS	Columbia soils, saline-alkali
CmSy	Columbia-Sycamore soils
CmTj	Columbia-Tujunga soils
CmTjRa	Columbia-Tujunga-Ramada soils
Co	Colusa soils, saline-alkali
CoSy	Colusa-Sycamore soils, saline-alkali
F	Freeport soils
Gl	Glann soils
Gr	Gridley soils
Hi	Hildreth soils
Ki	Kimball soils
L	Landlow soils
Ma	Marvin soils
MaS	Marvin soils, saline-alkali
Mc	Marcuse soils
Ni	Nicolaus soils
Pl	Placentia soils
PlCh	Placentia-Chualar soils
PlE	Placentia soils, eroded
PlHi	Placentia-Hildreth soils
Ra	Ramada soils
Ra/C	Ramada soils over clay
Sa	Sacramento soils
Sca	Stockton soils
Sj	San Joaquin soils
Sj (wet)	San Joaquin soils, wet
Su	Sutter soils
Sy	Sycamore soils
Tj	Tujunga soils
Tj/C	Tujunga soils over clay
Up	Upland soils
Wy	Wyman soils

SOILS	DOMINANT SOIL DEPTH	SOIL TEXTURE: SURFACE	SUBSOIL	LOWER SUBSOIL	DOMINANT CROPS
Alamo	2' ±	clay	clay	sandstone* – hardpan	cereals, range
Chualar	over 5'	loam	clay loam	sandy loam	almonds, sorghum
Columbia	over 5'	loam	loam	loam	orchards, row crops
Colusa	over 5'	silty clay loam	silty clay loam	silty clay loam	grain, sugar beets
Freeport	over 5'	clay	clay	clay loam	rice, grain
Glann	over 5'	clay loam	clay	clay	rice, grain
Gridley	4' ±	loam	clay loam	sandstone*	orchards, sorghum
Hildreth	2' ±	clay	clay	sandstone*	range
Kimball	over 5'	loam	clay	clay loam	grain, rice
Landlow	3'	silty clay loam	clay	sandstone*	rice, sugar beets
Marcuse	2'	clay	clay	sandstone*	rice, sorghum
Marvin	over 5'	silty clay loam	clay	silty clay loam	rice, tomatoes
Nicolaus	over 5'	clay	clay	clay loam	rice, grain
Placentia	over 5'	sandy loam	clay	clay loam	grain, sugar beets
Ramada	over 5'	silt loam and sandy loam stratified			orchards, row crops
Sacramento	over 5'	clay	clay	clay	rice, sorghum
San Joaquin	2'	loam	clay	hardpan	range, grain
Stockton	3'	clay	clay	sandstone*	rice, sorghum
Sutter	over 5'	sandy loam	loam	loam	orchards, row crops
Sycamore	over 5'	silty clay loam	silty clay loam	silty clay loam	row crops, orchards
Tujunga	over 5'	sand	sand	sand	orchards, row crops
Upland	2' – 5'	variable			range
Wyman	over 5'	loam	loam	loam	orchards, row crops

*This sandstone is a dense, softly cemented material similar to that under the hardpan of the San Joaquin soils.

HOW TO USE THIS MAP

The colors provide a general grouping of soils by major land forms - basins, ial fans, and terraces. Each color contains a number of map symbols of widely ng agricultural capabilities. A more complete description of the soils, their ement and variations will be found in the accompanying text.

Green	- Recent alluvial fan and flood plain soils with little or no increase in clay in the subsoil: Columbia, Tujunga, Wyman and Sutter are representative of this group.
Green	- Soil profiles with a moderate increase in clay in the subsoil: Gridley and Chular.
n Green	- Recent flood plain soils with a limiting factor such as alkali, salinity, or underlying clay layer.
Blue	- Basin soils with clay throughout the soil profile: Marvin, Sacramento, Freeport, Stockton.
Blue	- Basin soils: Landlow.
	- Terrace soils with soil profiles containing a maximum amount of clay increase in the subsoil: Placentia, Kimball and San Joaquin soils.
(uncolored)	- Upland soils of the Sutter Buttes; see text.